REMARKS

By the present Amendment, claims 1-3, 6, 9, and 18 have been amended. Claims 21 and 22 are newly presented for consideration. Accordingly, claims 1-4, 6, 8-10, and 18-22 are now pending in the application. Claims 1 and 18 are independent.

Applicants would like to thank Examiners Brutus and Chen for the courtesy and cooperation extended during the interview conducted on June 17, 2011. During the interview, Applicants discussed proposed amendments to the claims and features of the invention which were believed to differentiate and define over the cited references. In particular, Applicants indicated that the independent claims now require a single ultrasonic transducer in order to obtain sufficient information for constructing the 3-dimensional motion. In contrast, the cited references utilized multiple transducers and do not determine velocity components of 3D motion of the object. The Examiner agreed that the features of the invention did not appear to be disclosed by the cited references, but indicated that an updated search would be necessary in view of the clarifications resulting from the previous amendments and the interview.

By the present Amendment, Applicants have further amended independent claim 1 to define an ultrasonic motion detecting device that comprises:

> an ultrasonic transducer having piezoelectric elements arranged in an array, which transmit ultrasonic waves to an object and acquire reflection signals from the object;
>
> a motion detection unit that extracts a plurality of estimation regions which are used for estimating partial motions of the object from the reflection signals that are acquired by the ultrasonic transducer, and detects a three-dimensional motion of the object within the estimation regions; and

an image display unit that displays the three-dimensional motion within the estimation regions,

wherein ultrasonic wave scanning surfaces due to the ultrasonic transducer cross over each other, and

wherein the motion detection unit detects projected components that are detected from a plurality of first two-dimensional cross-section images of the object which are obtained from the ultrasonic transducer and a plurality of second two-dimensional cross-section images of the object which are obtained from the ultrasonic transducer to produce velocity components of the three-dimensional motion of the object which is positioned on an intersection line of the first and second two-dimensional cross-section images, and constructs the three-dimensional motion on the basis of the first two-dimensional cross-section image, the second two-dimensional cross-section image and the projected components.

The ultrasonic motion detecting device of independent claim 1 has been amended to include a single ultrasonic transducer which has piezoelectric elements arranged in an array for transmitting ultrasonic waves to an object and acquiring reflection signals from the object. A motion detection unit is provided for extracting a plurality of estimation regions that are used for estimating partial motions of the object from the reflection signals acquired by the ultrasonic transducer, and detecting a 3-dimensional motion of the object within the estimation regions. The device also includes an image display unit which displays the 3-dimensional motion within the estimation regions. According to independent claim 1, ultrasonic wave scanning surfaces that are due to the electronic transducer cross over each other. Furthermore, the motion detection unit detects projected components that are detected from a plurality of first 2-dimensional cross-section images of the object which are obtained from the ultrasonic transducer and a plurality of second 2-dimensional cross-section images of the object which are obtained from the ultrasonic transducer to produce velocity components of the 3-dimensional motion of

the object which is positioned on an intersection line of the first and second 2-dimensional cross-section images. The 3-dimesnional motion is then constructed based on the first 2-dimensional cross-section image, the second 2-dimensional cross-section image, and the projected components.

As discussed during the interview, the ultrasonic motion detecting device of independent claim 1 obtains biplane images that cross over each other, and sets a plurality of estimation regions. A 3-dimesnional motion vector is then constructed based on independent 2-dimesional motion vectors obtained from the biplane images. See paragraphs [0065] and [0066] of the published application. Furthermore, as illustrated in Figs. 2-4, the coordinate system being used to construct the 3-dimensional motion vector correspond to conventional Cartesian coordinates (i.e., x-y-z).

The combination of Lin, Hossack, and Otsuka was previously applied to reject claims 1-6, 8, and 18-20. As indicated in the previous Office Action, Lin fails to disclose various features recited in the claimed invention. Applicants note, however, that Lin is completely silent on constructing any 3-dimensional motion under any type of circumstances. In fact, Lin appears to only discuss obtaining biplane images for simultaneous viewing of an instrument in two ultrasound intersecting imaging planes.

Although the Office Action asserts that Otsuka discloses determination of velocity components for the 3-dimensional motion of an object, the dimensions being used by Otsuka are clearly different from those of the present invention. Otsuka explicitly indicates that velocity components corresponding to the directions of intersecting lines are obtained within a spatiotemporal region. See column 9, lines 20-28. As illustrated in Fig. 4, for example, the spatiotemporal space region is defined as a 2-dimensional space with a time (t) component. The only two Cartesian

coordinates present are X and Y. Therefore, any motion is, in fact, a 2-dimensional motion with respect to time. See also Figs. 8 and 9. Otsuka assumes that plural objects exist within a plane and that each object moves independently of the others. Otsuka is only capable of detecting one vector per object and drawing one movement track per object. Consequently, it is not possible for Otsuka to detect partial motion of the object which would correspond to movement and/or deformation of an inspection region within the object. Thus, even if combined, the combination of Lin and Otsuka would still fail to provide any disclosure or suggestion for constructing the 3-dimesnional motion of an object as set forth in independent claim 1.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-4, 6, 8-10, 19, and 21 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

By the present Amendment, Applicants have also amended independent claim 18 to define an ultrasonic motion detecting device that includes similar features to those now recited in independent claim. Accordingly, independent claim 18 is believed to be allowable over the art of record.

Claim 20 and 22 depend from independent claim 18, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 18. In addition, these claims introduce novel elements that independently render it patentable over the art of record.

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 520.46263X00).

Respectfully submitted,
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